

Office Action regarding (i) the difficulty in printing in view of the previous amendments to page 14, and (ii) the use of the term “fused.” Applicants respectfully submit that the replacement paragraphs proposed above should overcome these objections.

II. Rejection under 35 U.S.C. § 112, Second Paragraph

Claims 1-17, 41 and 42 stand rejected under 35 U.S.C. § 112, second paragraph on the ground that the word “mounting” appears incorrect in claim 1, line 12. Applicants have amended claim 1 to replace the word “mounting” with --mating--. Reconsideration is respectfully requested in view of this amendment. 

III. Claim Rejections – 35 U.S.C. § 103(a)

All of the pending claims have been rejected under 35 U.S.C. § 103(a) as being obvious over various combinations of the cited art. Since the rejections involve multiple references, Applicants have divided the discussion below into segments. First, however, Applicants have briefly summarized the requirements of an obviousness rejection below.

Applicants encourage the Examiner to contact the undersigned to discuss the arguments made herein and, if necessary, to discuss changes which would place the case in condition for allowance.

A. The Obviousness Standard

A *prima facie* case of obviousness has three elements. One element requires that the references teach all of the claimed features. Another element demands that a suggestion or motivation exist to combine references. The final element requires a reasonable expectation of success in combining the references.

Applicants assert that this Office Action, as well as the earlier Office Actions, has failed to establish a *prima facie* case of obviousness. Where, as here, multiple references have been combined to support an obviousness rejection, there must be some suggestion or motivation to combine those references. *In re Rouffet*, 149 F.3d 1350 (Fed. Cir. 1998). Broad, conclusory statements are unacceptable. *In re Dembiczak*, 175 F.3d 994 (Fed. Cir. 1999). The Federal Circuit has cautioned that “the best defense against the subtle but powerful attraction of a hindsight-based obviousness analysis is rigorous application of the requirement for a showing of the teaching or motivation to combine prior art references.” *In re Gardside*, 203 F.3d 1305, 1319

(Fed. Cir. 2000). Stated differently, the motivation to combine references must be “clear and particular.” *Dembiczak*, 175 F.3d at 999. The Office Action fails to provide this clear and particular showing.

B. The Rejection over Feldman or Kandybowski in view of Romine, Noschese, Seidler, Lin, Teka, Electronics and Swamy and the Rejection over Fedder in view of Noschese, Swamy, Romine, Lin, Seidler, Electronics, and Feldman.

Claims 1-17, 41 and 42 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Fedder in view of Noschese, Swamy, Romine, Lin, Seidler, Electronics and Feldman.

Claims 18-31, 43, 32-40, 44 and 45 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Feldman or Kandybowski, either one taken in view of Romine, Noschese, Seidler, Lin, Teka, Electronics and Swamy. For the various reasons enumerated below, these rejections should be withdrawn.

1. Claims 1, 2, 4-17, 41 and 42

Independent claim 1 recites, *inter alia*, that the signal contacts have a mating portion with “an elongated cross-section” arranged transversely between the elongated cross-sections of the ground or power contacts such that one end “is located adjacent” one of *the ground or power contacts*, and the other end “is located adjacent” another of *the ground or power contacts*.

Fedder, which is the only art cited by the Examiner in reference to this feature, does not disclose such an arrangement. While the contacts illustrated in the Figures of Fedder may appear to have an elongated cross-section, Fedder does not teach or suggest “an elongated cross-section” arranged transversely between the elongated cross-sections of the ground or power contacts such that one end “is located adjacent” one of *the ground or power contacts*, and the other end “is located adjacent” another of *the ground or power contacts*, as recited in claim 1.

The Office Action continues to assert that this aspect of the present invention does not “relate to the ‘solder masses’ aspect to which this case is mainly directed.” That, however, is irrelevant. This feature is recited in these claims, and cannot be ignored, whether or not it relates to any other aspect of the described invention. Applicants respectfully submit that none of the cited references teaches or suggests the combination recited in these claims and respectfully request reconsideration of their rejection.

In addition to the above discussion regarding independent claim 1 and its other dependent claims, Applicants assert that dependent claim 13 itself defines an invention that is patentable

over the cited references. Claim 13 recites, *inter alia*, “recesses” in which the mounting portions of the contacts reside. None of the cited references disclose or suggest such an arrangement. Applicants request that the Examiner reconsider and withdraw the rejection of claim 13.

2. Claims 18-31, and 43.

Independent claim 18 recites, *inter alia*, an electrical connector with contacts that “remain[] a distance away from the circuit substrate” and have solder masses “fused” thereto “before said connector mounts to the circuit substrate.”

(a) “Remaining a Distance Away”

Kandybowski and Feldman fail to disclose or to suggest this feature. Feldman, as seen in Figure 3, discloses connectors (2,4) with contacts (12) that mount to through-holes in a PCB (6,8). Kandybowski discloses both a through-hole mounted connector (22) and a surface mounted connector (84). In either case, the contacts do not “remain a distance away” from the circuits substrate as described in claim 18. The contacts of the through-hole mounted connector extend into the circuit substrate, and the contacts of the surface mounted contact directly engage the circuit substrate.

Furthermore, no suggestion has been clearly asserted which provides a motivation to modify Kandybowski or Feldman to satisfy the features of claim 18. For at least this reason, the rejection should be withdrawn. Applicants request that the Examiner reconsider and withdraw the rejection.

(b) Fused to the “Contact”

Swamy and Lin fail to disclose or to suggest this feature. Swamy discloses solder balls (212) attached to pads (210) on the bottom of the connector (200). Lin discloses a semiconductor die (12) with solder bumps (16) secured to bonding pads (14). No motivation has been established to utilize these references in securing a solder mass to a contact of an electrical connector as described in the claim. For at least this reason, the rejection based upon these references should be withdrawn. Applicants request that the Examiner reconsider and withdraw the rejection.

(c) “Fused” to the Contact “Before” the Connector Mounts to the Circuit Substrate

Romine, Seidler and Teka fail to disclose or to suggest this feature. As provided in column 3, lines 19 and 20 of Romine, the solder pellets (52) are preferably “stuck in and on the

cavity 50 with a suitable adhesive.” When mounting the connector to the PCB, “the header 30 and board 22 can be placed in an assembly oven, and the temperature within the oven raised sufficiently to melt the reflux solder pellets 52.” Seidler discloses a solder mass (26) placed between tabs (18) on the contact (10). The solder mass is subsequently heated to secure the connector to a PCB. Likewise, Teka appears to disclose an electronic component with a lead having a shaped piece of solder placed thereon. No motivation has been established to utilize these references in fusing a solder mass to the contact before the connector mounts to the circuit substrate. For at least this reason, the rejection based upon these references should be withdrawn. Applicants request that the Examiner reconsider and withdraw the rejection.

In addition to the above discussion of independent claim 18, Applicants assert that dependent claims 22-25 themselves define inventions that are patentable over the cited references. Claim 22 recites, *inter alia*, that the housing has “recesses” in which the mounting portions of the contacts reside. None of the cited reference disclose or suggest such an arrangement. Applicants request that the Examiner reconsider and withdraw the rejection of claims 22-25.

3. Claims 32-41, 44 and 45

Applicants assert that the rejection was improper and must be withdrawn. Claim 32 recites, *inter alia*, an electrical connector with a solder mass “fused” to the tail portion of the contact “prior to” the electrical connector securing to the substrate so that the solder mass is located “further” from the housing than the contact.

(a) Solder Mass “Further” from Housing

Kandybowski and Feldman fail to disclose or to suggest this feature. Feldman (Figure 3) discloses connectors that mount to through-holes in a PCB. It would appear that placing the solder mass at the end of a through hole-mounted contact prevents the contact from aligning with and entering the through-hole of the PCB. For at least this reason, the rejection based upon this reference was improper and must be withdrawn.

Kandybowski discloses, in one embodiment (connector 22 in Figure 4), a through hole-mounted connector, and, in another embodiment (connector 84 in Figure 4), a surface-mounted connector in which the contacts directly engage the PCB. It would appear that placing the solder mass at the end of the contact prevents the contact from aligning with and entering the through-hole or prevents the contact from engaging the PCB directly. For at least this reason, the

rejection based upon this reference was improper and must be withdrawn.

In addition, no suggestion has been clearly asserted which provides a motivation to modify Kandybowski or Feldman to satisfy the features of claim 32. For at least this reason, the rejection should be withdrawn. Applicants request that the Examiner reconsider and withdraw the rejection.

(b) Fused to the “Contact”

Swamy and Lin fail to disclose or to suggest this feature. Swamy discloses solder balls (212) attached to pads (210) on the bottom of the connector (200). Lin discloses a semiconductor die (12) with solder bumps (16) secured to bonding pads (14). No motivation has been established to utilize these references in securing a solder mass to a contact of an electrical connector as described in the claim. For at least this reason, the rejection based upon these references should be withdrawn. Applicants request that the Examiner reconsider and withdraw the rejection.

(c) “Fused” to the Contact “Prior to” the Connector Mounting to the PCB

Romine, Seidler and Teka fail to disclose or to suggest this feature. As provided in column 3, lines 19 and 20 of Romine, the solder pellets (52) are preferably “stuck in and on the cavity 50 with a suitable adhesive.” When mounting the connector to the PCB, “the header 30 and board 22 can be placed in an assembly oven, and the temperature within the oven raised sufficiently to melt the reflux solder pellets 52.” Seidler discloses a solder mass (26) placed between tabs (18) on the contact (10). The solder mass is subsequently heated to secure the connector to a PCB. Likewise, Teka appears to disclose an electronic component with a lead having a shaped piece of solder placed thereon. No motivation has been established to utilize these references in fusing a solder mass to the contact before the connector mounts to the circuit substrate. For at least this reason, the rejection based upon these references should be withdrawn. Applicants request that the Examiner reconsider and withdraw the rejection.

C. Rejection of Claims 18-31, 43, 32-40, 44 and 45 over Romine in view of Noschese, Seidler, Electronics, Teka, Lin and Swamy

Claims 18-31, 43, 32-40, 44 and 45 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Romine in view of Noschese, Seidler, Electronics, Teka, Lin and Swamy. For the various reasons enumerated below, the rejection should be withdrawn.

1. Claims 18-31, and 43

Independent claim 18 recites, *inter alia*, an electrical connector with contacts that have solder masses “fused” thereto “before said connector mounts to the circuit substrate.”

As seen in Figure 5, Romine describes an electrical connector (20) with solder pellets (52) secured to pins (32) with adhesive. No motivation has been established to modify Romine as described in the claim. In fact, none of the cited references provide such a motivation. Applicant requests that the Examiner reconsider and withdraw the rejection.

In addition to the above discussion of independent claim 18, Applicants assert that dependent claims 22-25 themselves define inventions that are patentable over the cited references. Claim 22 recites, *inter alia*, that the housing has “recesses” in which the mounting portions of the contacts reside. None of the cited references disclose or suggest such an arrangement. Applicants request that the Examiner reconsider and withdraw the rejection of claims 22-25.

2. Claims 32-41, 44 and 45

Likewise, independent claim 32 recites an electrical connector with a solder mass “fused” to the tail portion of the contact “prior to” the electrical connector securing to the substrate so that the solder mass is located “further” from the housing than the contact.

Again, Figure 5 of the Romine shows an electrical connector (20) with solder pellets (52) secured to pins (32) with adhesive. No motivation has been established to modify Romine as described in the claim. In fact, none of the cited references provide such a motivation. Applicant requests that the Examiner reconsider and withdraw the rejection.

D. Other Considerations

When determining obviousness, the Examiner must also consider factors that evidence non-obviousness. One such factor is when an applicant proceeds contrary to accepted wisdom. M.P.E.P. § 2146.

The present invention is the first “typical” electrical connector to utilize ball grid array (BGA) technology. By “typical,” the undersigned refers to an electrical connector which includes a housing and contacts mounted in the housing.

The Examiner has cited several references¹ which disclose the use of BGA technology on electronic components. However, several significant differences exist between the use of BGA

¹ Lin, Teka and Electronics.

technology on electronic components and on electrical connectors. Applicants assert that these differences help establish the non-obviousness of the present invention.

One major difference between electronic components and electrical connectors is the types of materials used. Electronic components are generally made from materials, such as ceramics, that are generally unaffected by the reflow process that secured the solder balls to the leads. Electrical connectors, especially ones made from plastic, have a greater sensitivity to the temperatures encountered during the reflow process.

Another major difference between electronic components and electronic connectors is the type of use each device encounters. Once secured to the PCB, electrical connectors must engage a mating component, often through multiple mating/unmating cycles. Electronic components, typically, do not encounter such cycling. This cycling may transmit forces to the solder joint between the contact and the PCB. These forces may affect the solder joint of the electrical connector differently than the solder joint of the electronic component, which does not encounter such cycling. For at least these reasons, Applicants have established the non-obviousness of the present invention.

The Examiner has also cited several references² which disclose mere "typical" connectors, stating that it would have been obvious to apply BGA technology to these connectors. Applicants assert that such a conversion goes against conventional wisdom.

First, due to the mating/unmating cycles of electrical connectors, Applicants believe that conventional wisdom urges the interaction of at least a portion of the connector structure with the PCB. For instance, Feldman and Fedder describe connectors with contacts extending into through-holes in the PCB. Romine discloses a portion of the connector housing extending into the PCB. Also, in the one entirely surface mounted connector embodiment of Kandybowski (see Figure 3), the connector housing receives an edge of the card and the contacts directly engage the PCB. For at least this reason, Applicants assert that mounting a "typical" connector to a PCB using only BGA technology appears contrary to conventional wisdom.

Second, the "typical" connectors cited by the Examiner only encounter, at most, a single reflow operation. The connector of Fedder, which discloses all through-hole tails, does not appear to encounter any reflow operation. As is customary with through-hole tails, the undersigned assumes that a wave soldering operation secures the contacts of the Fedder

2 Fedder, Feldman, Kandybowski, and Romine.

connector to the PCB. Feldman, Kandybowski and Romine appear to encounter only one reflow operation.

One problem encountered during a reflow operation is the wicking of the solder mass along the contact and away from the solder joint. Importantly, the connector of the present invention undergoes two reflow operations. One reflow operation occurs when the solder masses are initially secured to the contact. The second reflow operation occurs when the connector is mounted to the PCB. Clearly, exposing a connector to an additional reflow operation proceeds contrary to accepted wisdom. Thus, Applicants have again established the non-obviousness of the present invention.

Finally, the Examiner has cited a reference³ describing an atypical connector. Swamy describes a connector housing (202) with insulative pegs (204) extending from one side. The pegs have conductive strips (206) “brazed” thereon⁴. Plated through holes or vias 208 extend through the housing to connect the conductive strips with conductive pads (210) plated on the opposite side of the housing. The pads receive solder balls (212). The Swamy device is atypical since it resembles a PCB more than a connector. As is known, a PCB can have solder pads and plated through-holes/vias. Without mounting the solder masses to a contact, the Swamy device does not present the potential for the solder wicking problem described above. Therefore, Applicants assert that the Swamy reference provides no motivation to apply BGA technology to a “typical” connector. Thus, Applicant has established the non-obviousness of the present invention. Applicant requests that the Examiner reconsider and withdraw the rejection.

IV. Conclusion

In light of the foregoing, Applicants submit that the claims are now in condition for

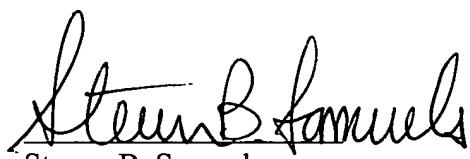
³ Swamy.

⁴ The Swamy disclosure is unclear. The term brazing refers to the soldering of two metallic elements. Swamy is unclear since the disclosure describes the brazing of metal to plastic.

allowance. Reconsideration of the Office Action of February 12, 2001 and an early Notice of Allowance are respectfully solicited.

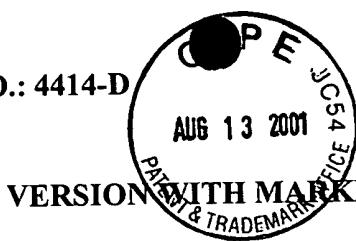
Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

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IN THE CLAIMS:

Claim 1 has been amended as follows:

1. (Four Times Amended) An electrical connector, comprising:
 - a dielectric base;
 - a plurality of ground or power contacts in said dielectric base and comprising:
 - a mating portion for engaging a mating component, said mating portion having an elongated cross-section; and
 - a mounting portion for securing the connector to a substrate;
 - a plurality of signal contacts in said dielectric base, and comprising:
 - a mating portion for engaging a mating component, said mating portion being generally planar and having an elongated cross-section, said elongated cross-section of said mating portion of said signal contacts oriented generally transverse to said elongated cross-section of said [mounting] mating portion of said ground or power contacts so that one end of said elongated cross-section is located adjacent one of said ground or power contacts and an opposite end of said elongated cross-section is located adjacent another one of said ground or power contacts; and
 - a mounting portion for securing the connector to a substrate; and
 - a plurality of solder masses, each secured to a respective one of said mounting ends of said plurality of ground or power contacts and said plurality of signal contacts for securing the connector to the substrate.

IN THE SPECIFICATION:

The following shows the amendments to the paragraphs at page 14, lines 13-26 made herein and in the Reply Under 37 C.F.R. § 1.111 of October 5, 1999:

-- Longitudinally extending metallic grounding or power elements 436, 438, 440, 442, 444 and 446 are positioned between the rows of signal pins and extend perpendicularly from the base section. The plug also includes alignment and mounting pins 448 and 450 which enter

corresponding openings (not shown) in a substrate (not shown) during mounting. On its bottom, or mounting, side the plug also includes a plurality of rows of solder conductive tabs [as at] to which solder masses, such as the solder balls 452 and 454 [.] shown in Figure 26, secure (i.e., are fused). As seen in Figure 33, the solder conductive tab of contact 434 is an angled portion 453 which resides in a recess 455 in the base. As customary in ball grid array assemblies, solder balls 452, 454, once reflowed, secure plug 420 to a substrate (now shown).

Referring to Figures 28-31, a receptacle which mates with the plug 420 is shown generally at numeral 456. This receptacle includes a base section dielectric 458, a peripheral bevelled edge [recess] 460 and rows of metallic pin receiving recesses as at 462, 464, 466, 468 and 470. Metallic grounding or power elements receiving structures 472, 474, 476, 478, 480 and 482 are interposed between the rows of pin receiving recesses. On its bottom, or mounting, side the receptacle also includes alignment and mounting pins 484 and 486 [and] which enter corresponding openings (not shown) in a substrate (not shown) during mounting. Further, the bottom side of the receptacle includes rows of solder conductive pads [as at] to which solder masses, such as the solder balls 488 and 490 [.] shown in Figure 30, secure (i.e., are fused). As seen in Figure 33, the solder conductive pad of contact 470 is an angled portion 456 which resides in a recess 459 in the base. As customary in ball grid array assemblies, solder balls 488, 490, once reflowed, secure receptacle 456 to a substrate (not shown). From Figures 32-33 it will be observed that the same I-beam geometry as was described above is available with this arrangement. --